

# **OVERVIEW**

# **EARTH SCIENCES DIVISION**

**Bo Bodvarsson**  
**Division Director**

**Lawrence Berkeley National Laboratory**

**February 12-13, 2002**



**EARTH SCIENCES DIVISION**

**2002 DIRECTOR'S REVIEW**



# Review Agenda

- **ESD Overview** **Bo Bodvarsson**
- **Hydrology & Reservoir Dynamics (HRD) Overview** **Chin-Fu Tsang**
- **Scientific Presentations** **Principal Investigators**
- **Poster Session** **Principal Investigators**
- **Laboratory Tours** **Principal Investigators**
- **Executive Session** **Review Committee**



# Scope of the Review

- **Scientific Quality**
  - This year's review will focus on the Hydrology and Reservoir Dynamics (HRD) Department. (The HRD Department comprises ~30% of the Earth Sciences Division.)
- **Effectiveness of Division Management**
- **Division Responsiveness to DOE Needs**
- **Ability to Assess and Act on New Opportunities**



# Outline of Presentation

- **ESD and Lab Management Structure**
- **ESD Mission and Purpose**
- **ESD Staffing and Budget**
- **Our Work**
- **Securing Our Future**
- **Enhancing Our Staff/Capabilities**

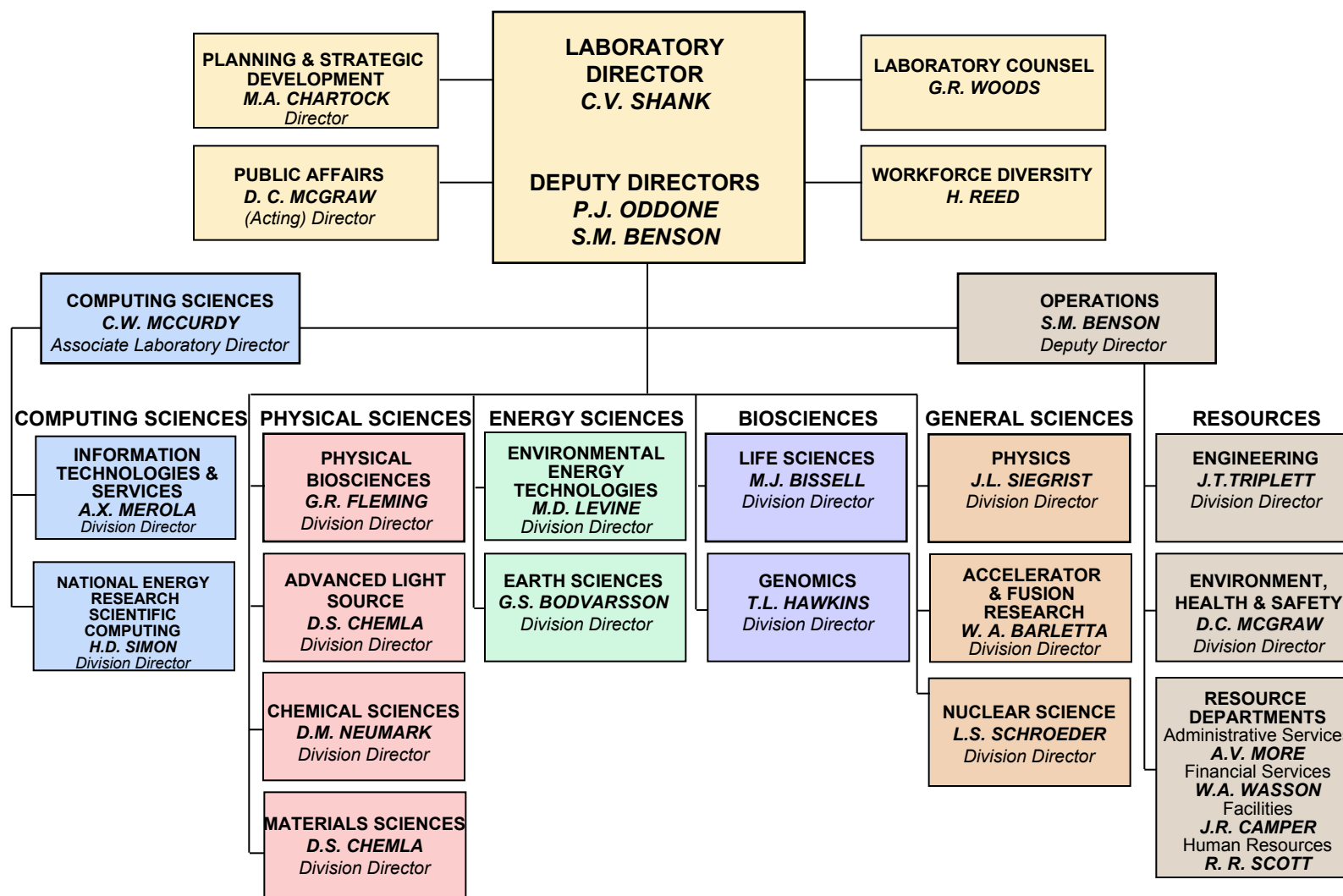


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# Berkeley Lab Organizational Structure

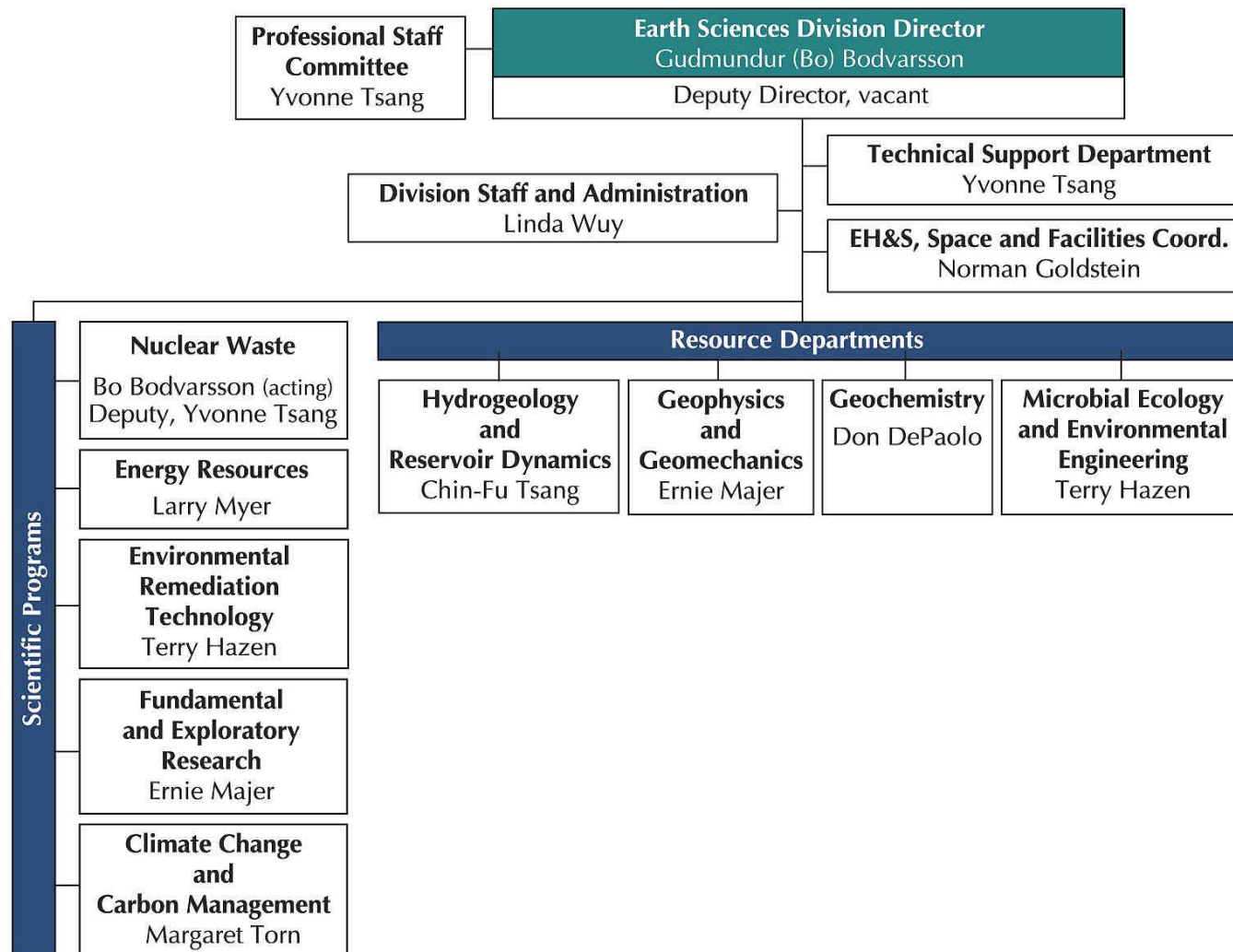


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# ESD ORGANIZATION



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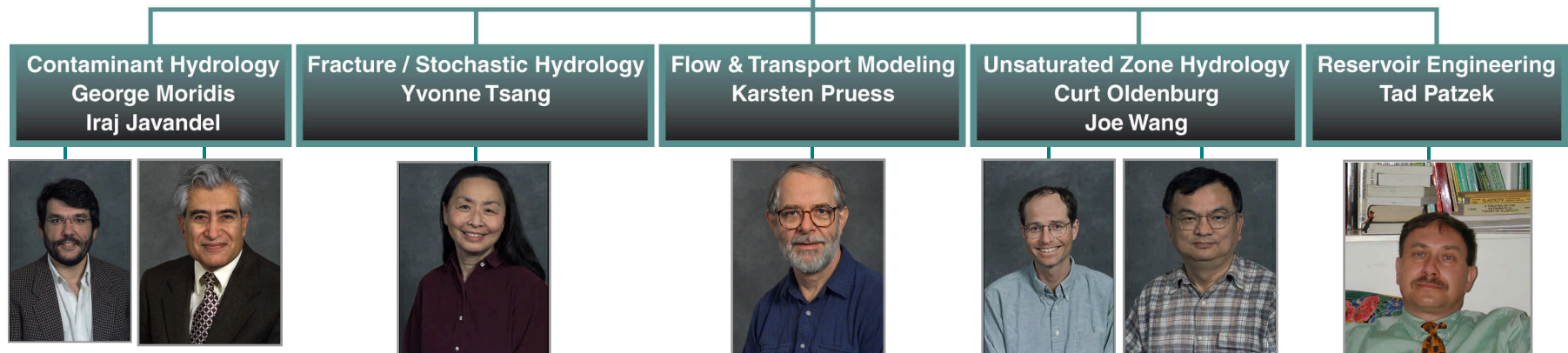
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# Hydrogeology Reservoir Dynamics Dept.



Chin-Fu Tang  
Head



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# ESD Mission and Purpose

- To create new knowledge and understanding of earth sciences in order to provide effective solutions with significant impact to energy and environmental problems of national and global importance
- To continually strive for improvements in safety, the quality of science and employee work satisfaction



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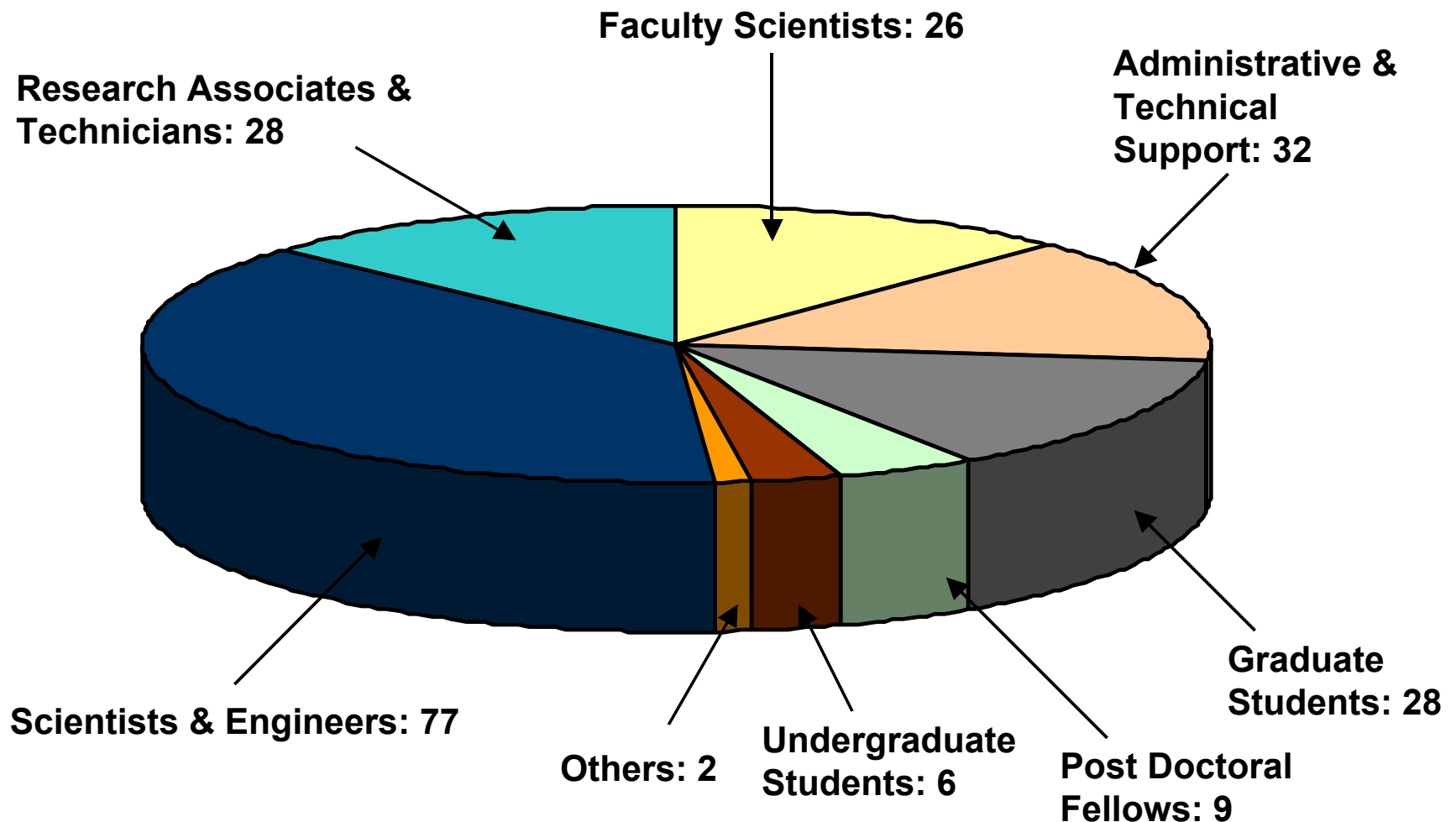
# ESD STAFFING AND BUDGET



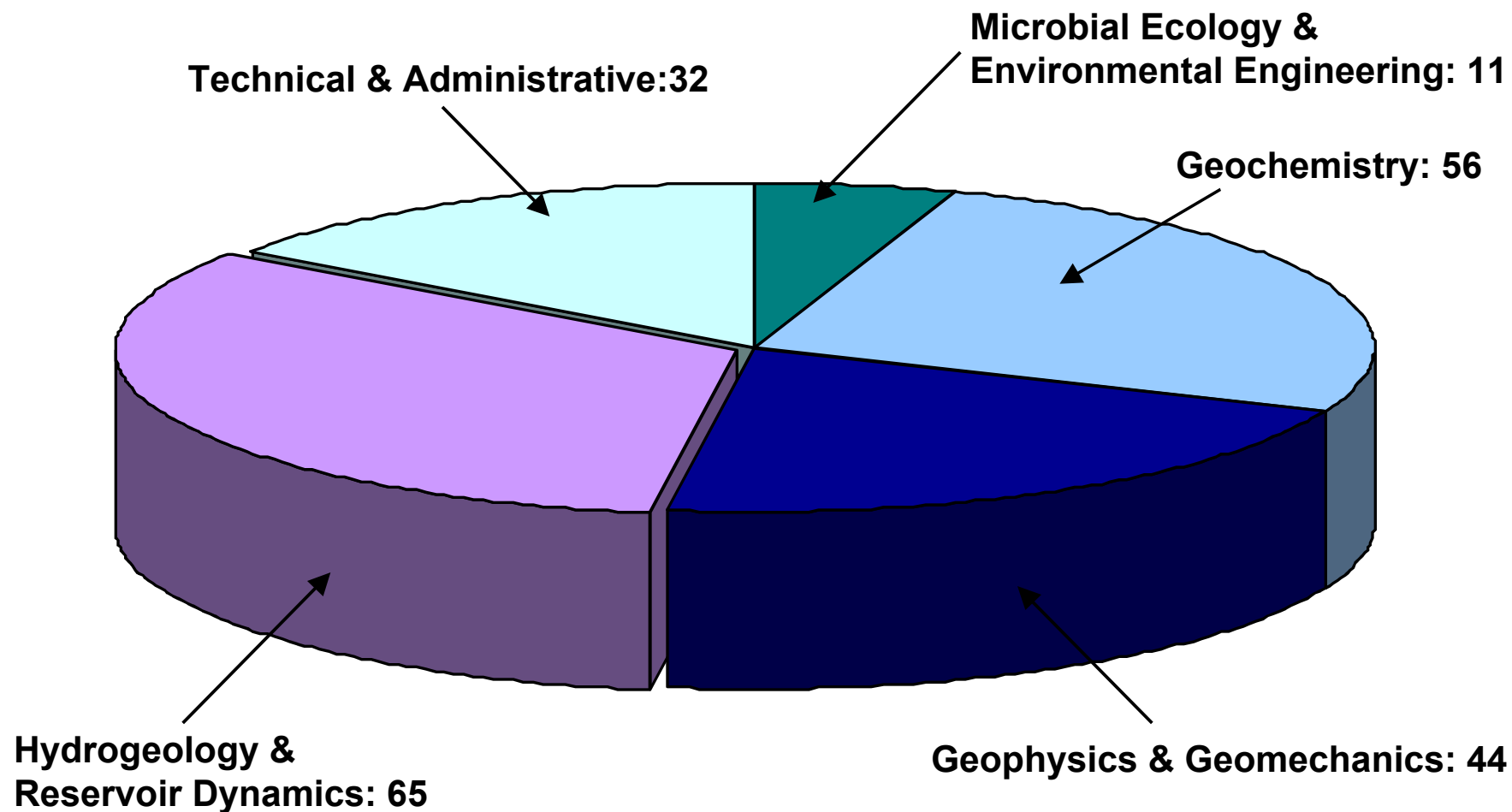
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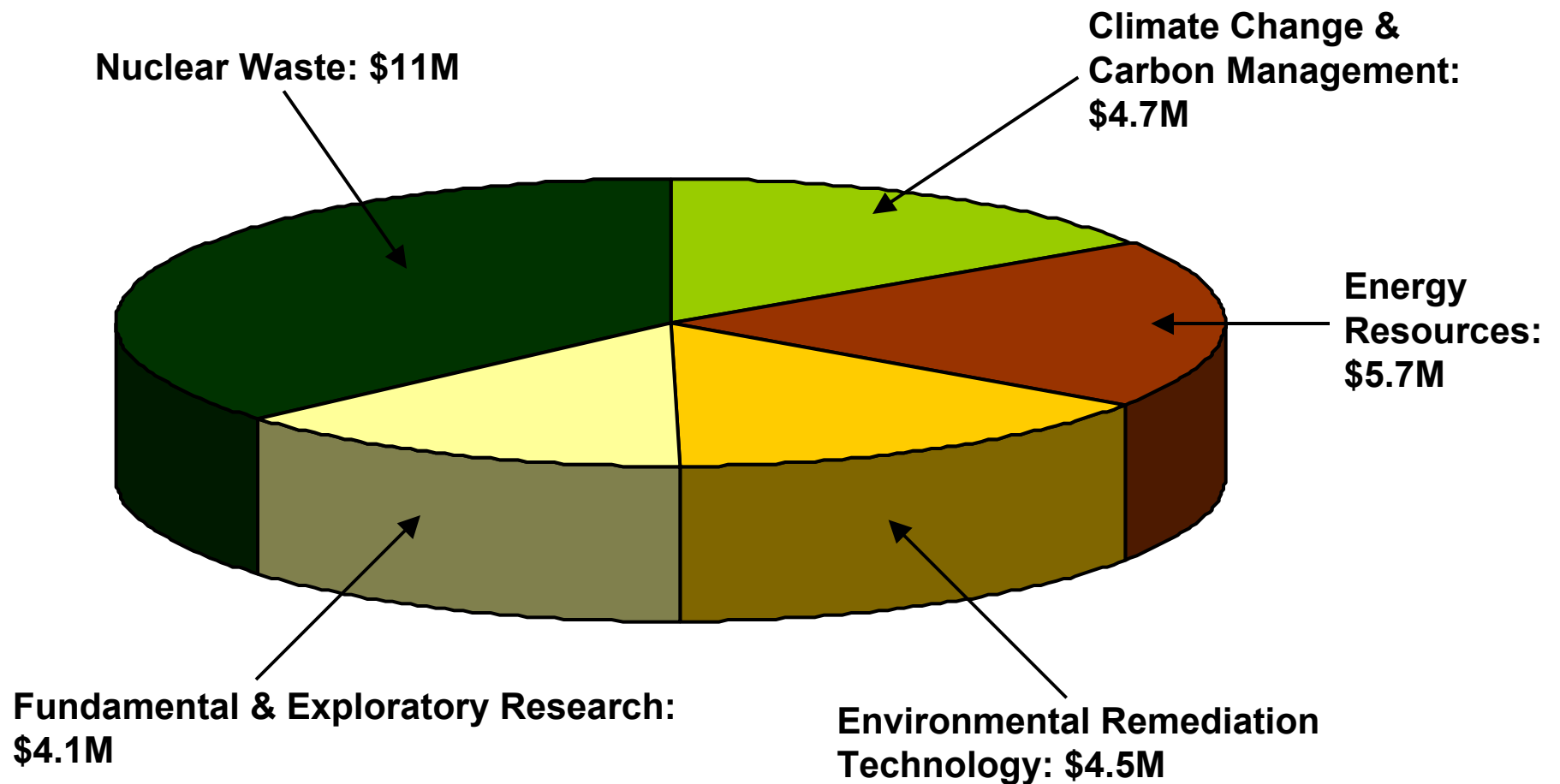
# ESD Staffing - 208 Total



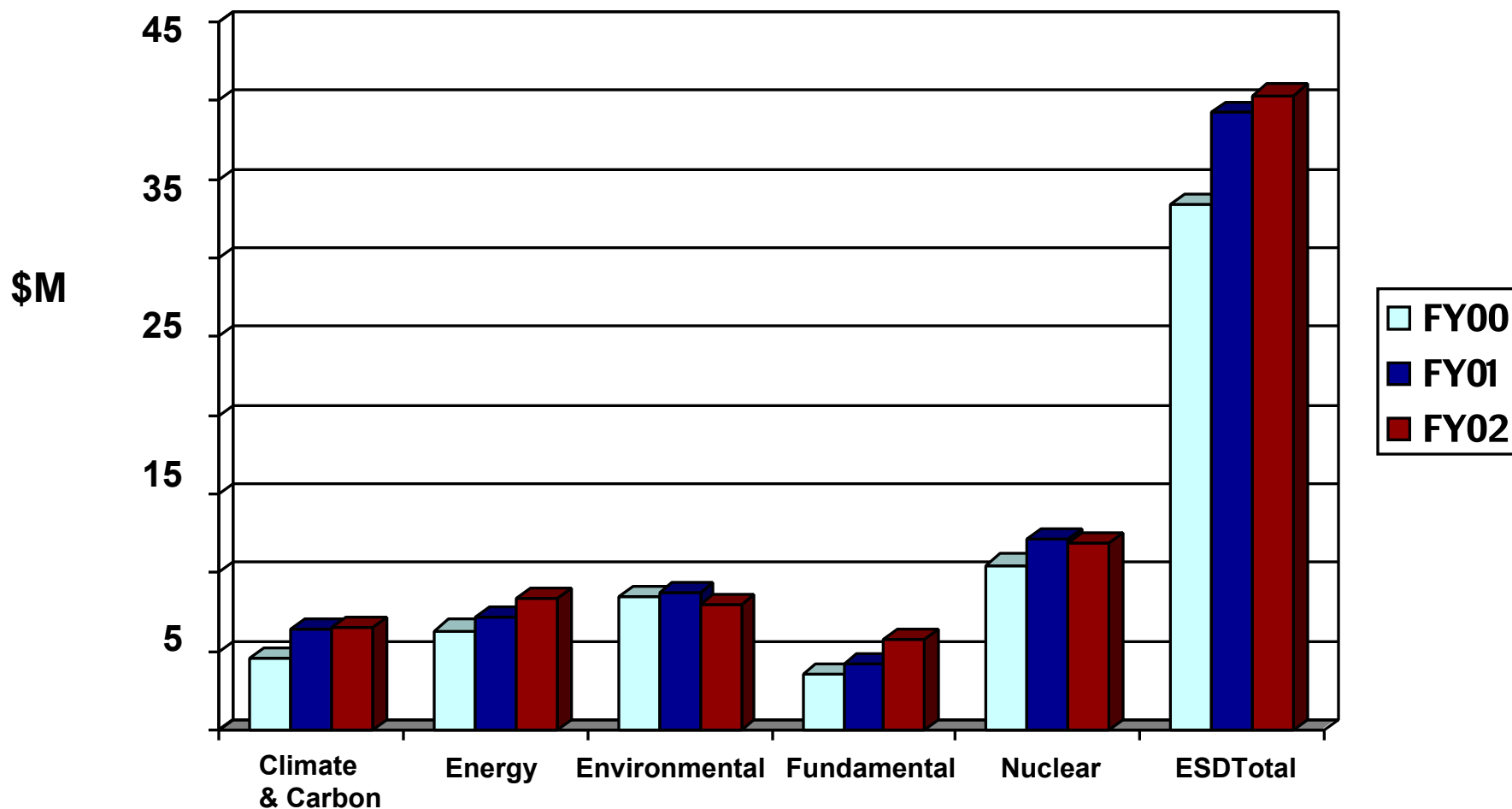
# ESD Staffing By Departments



# ESD Funding (FY2002: \$30M)



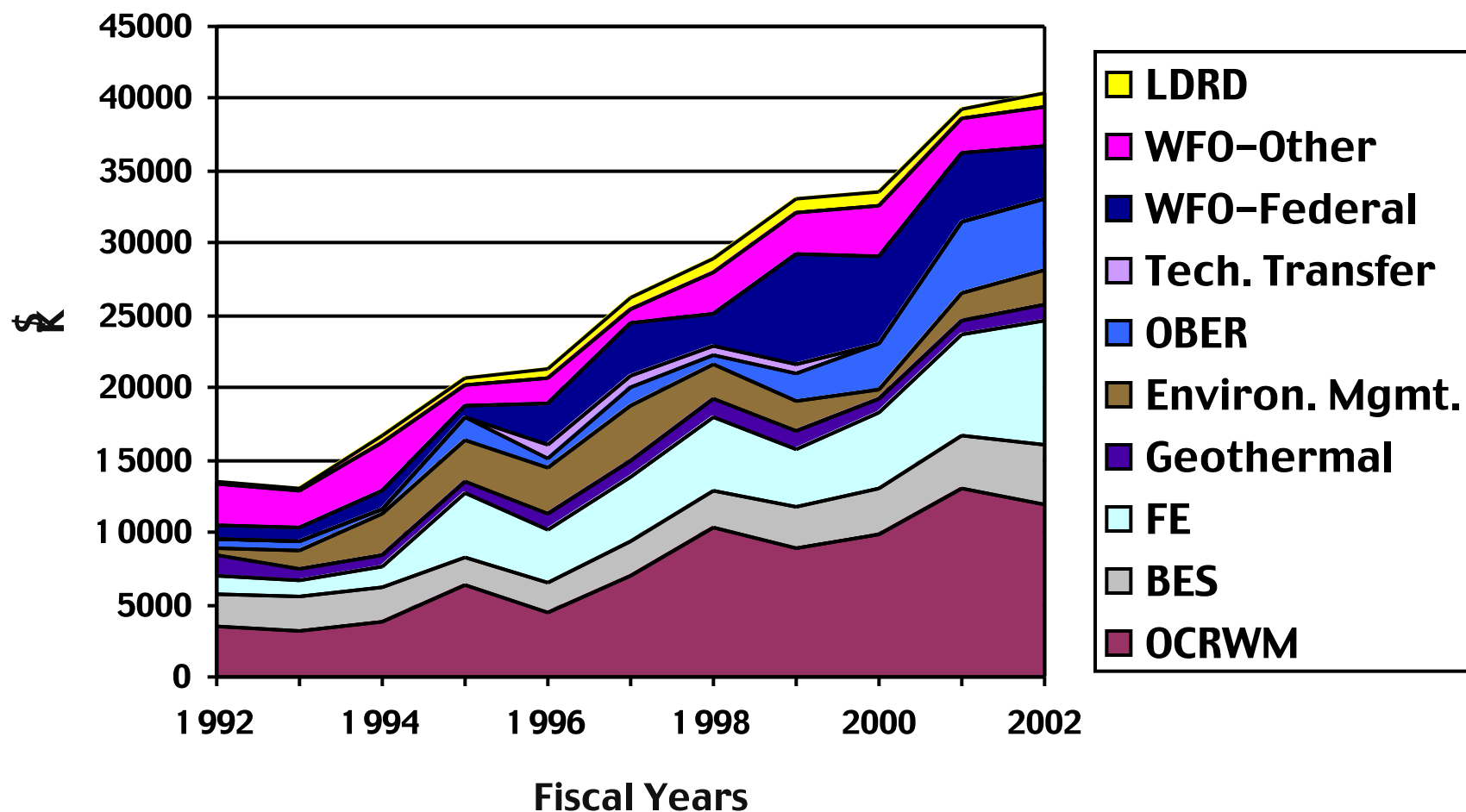
# ESD Budget FY00 to FY02



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# ESD Budget by Sponsor FY92 to FY02



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# OUR WORK

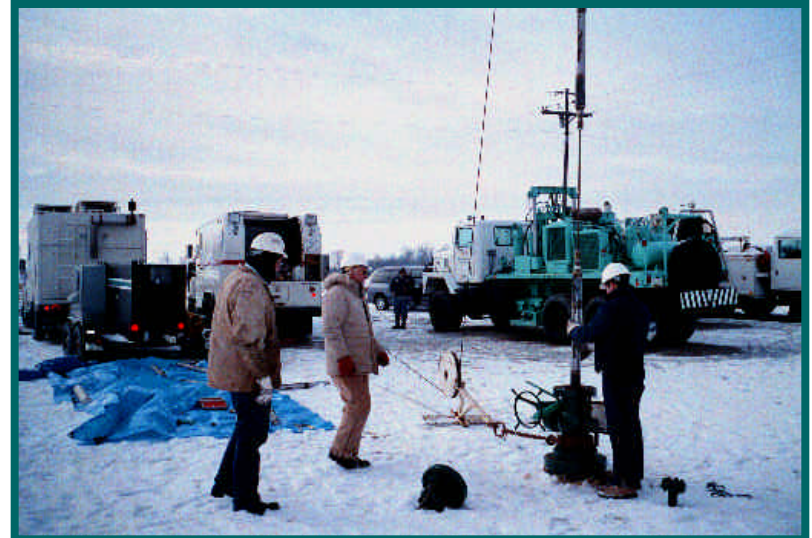


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# OUR WORK: Geophysics/Geomechanics Research

- Laboratory and Theoretical Studies
- Field and Data Acquisition
- Modeling/Inversion
- Processing, Integration, and Interpretation



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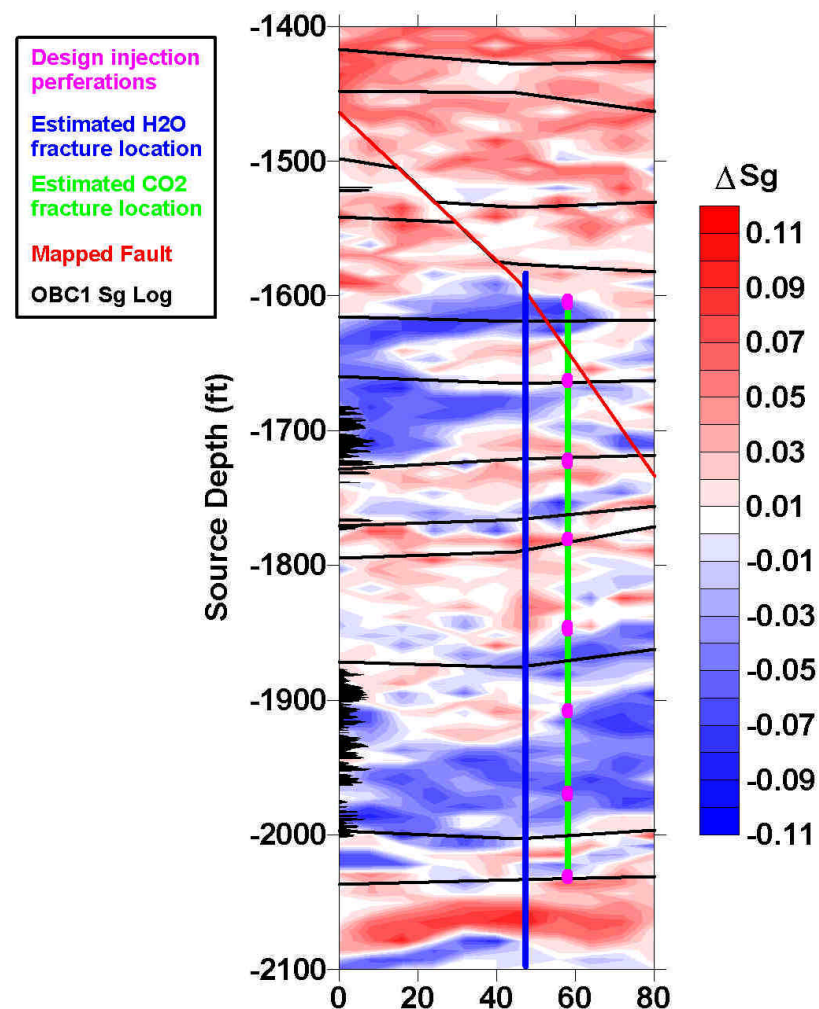
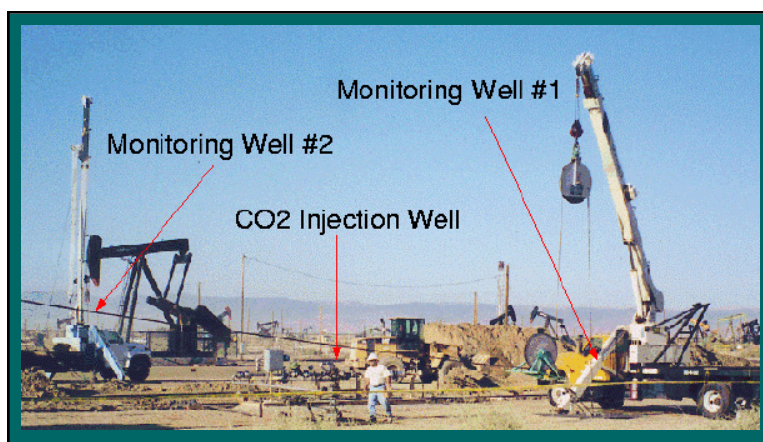
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# OUR WORK: Energy Resources

- Fluid imaging increases efficiency of oil and gas production
- Crosswell seismic and crosswell electromagnetic imaging used together to obtain changes in gas saturation during injection of CO<sub>2</sub> for enhanced oil recovery
- Images indicate CO<sub>2</sub> migrated above target zone possibly due to over pressurization



# OUR WORK: Ocean Carbon Sequestration

- **Ocean Biogeochemical Processes Group**

- to bridge the space-time gap in ocean carbon cycle observations - funding NOPP/NOAA/NASA/DOE

- **Ocean Carbon Sequestration Research for DOE**

- now in progress south of New Zealand
  - to understand where the carbon goes in the southern ocean fertilization experiment
  - trace metal/carbon cycle dynamics

- **Instrument Development SOLO-Robots Carbon Explorers**

- 6 new systems deployed in both northern and southern oceans



*First SeaWiFS image of SOFEX area February 6 2002*

SOLO2104 followed the Fe fertilized water over 200 km distance - and 3 weeks.

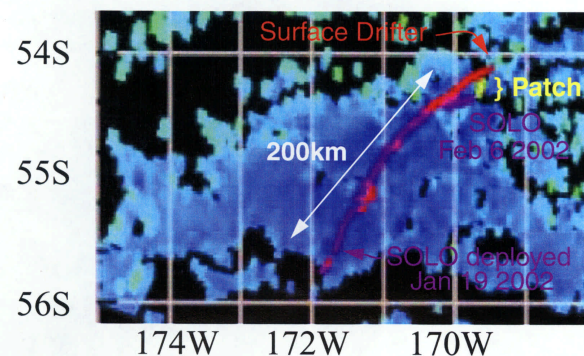


Image courtesy of SOFEX and SeaWiFS



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# OUR WORK:

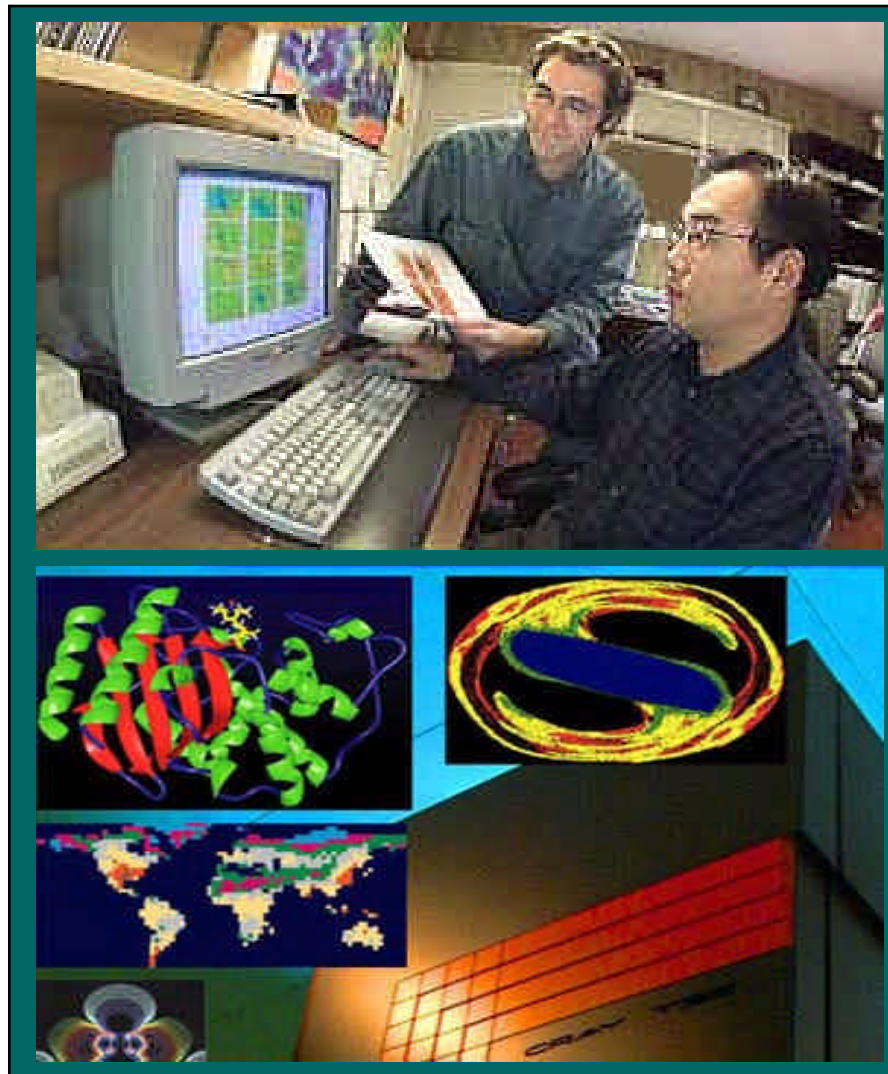
## Climate and Water Resources Research

### CA Water Resources Research and Applications Center

- Seasonal climate predictions for use by the Water and Agriculture Sectors. Information system for monitoring water quality
- Transfer of applications research to local, state government agencies

### National Energy Resources Super Computer (NERSC)

- Coupling of land surface and atmospheric regional models using NERSC
- Investigate trending variables for climate records and climate change assessment



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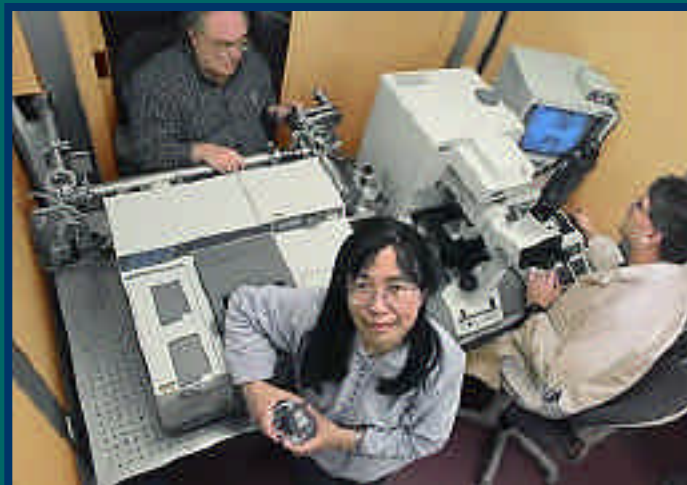
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# OUR WORK: The Advanced Light Source (ALS)

- Real-time changes in cell and sediment using synchrotron FTIR/Hoi-Ying Holman
- Has been used to show the relationship between humics and pyrene bioavailability in surface soils
- Has been used to demonstrate human risk to Polynuclear Aromatic Hydrocarbons (PAHs) at petroleum contaminated sites by directly detecting changes in human cells



# OUR WORK: Environmental Remediation Technology

- Injection of air into solid waste landfills has been shown to increase the biodegradation rate by nearly forty times
- The increased biodegradation rate has increased subsidence and decreased odors and cleaned up the leachate and stopped methane production (greenhouse gas)
- These findings both in the laboratory and the field have demonstrated how landfills can be stabilized in less than 2-3 years instead of the 30 year expectation that we have now
- Developing a coupled biological, chemical, hydrological model to investigate landfill processes



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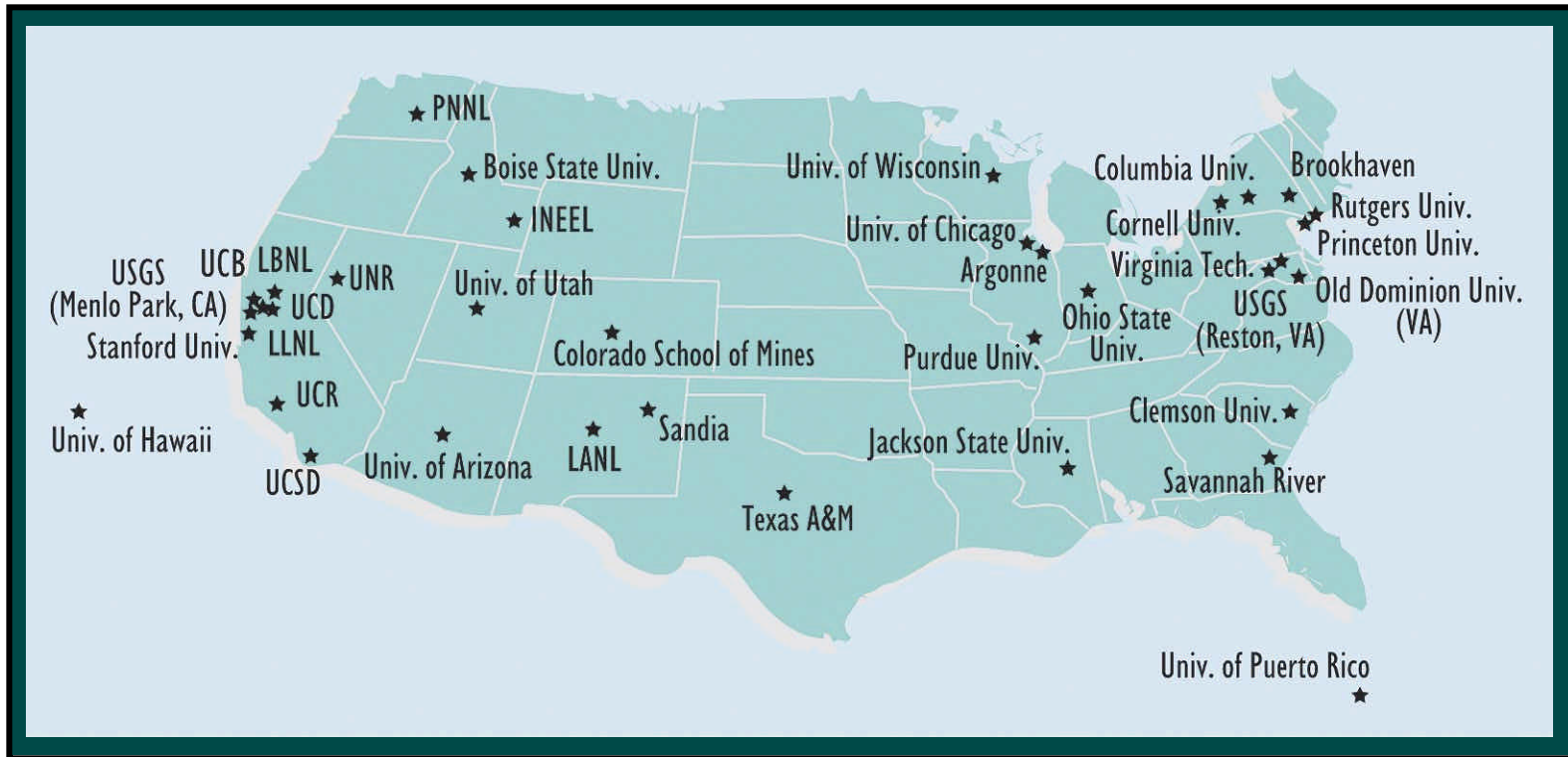
# OUR WORK: Quality Assurance (QA)

- An important part of the OCRWM research is devoted to rigorous QA practices
- A group of ~15 professionals comprise our QA team
- Expert range from software QA, data QA, procedure development and training





# ESD Researchers Collaborate with Universities and Laboratories Across the United States



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# Securing Our Future

- **Develop new major programs in**
  - Water Cycle
  - Center for Deep Underground Science
  - Regional Carbon Sequestration Center
  - Anti-terrorism Science
  - Vadose Zone
  - Long-term Stewardship



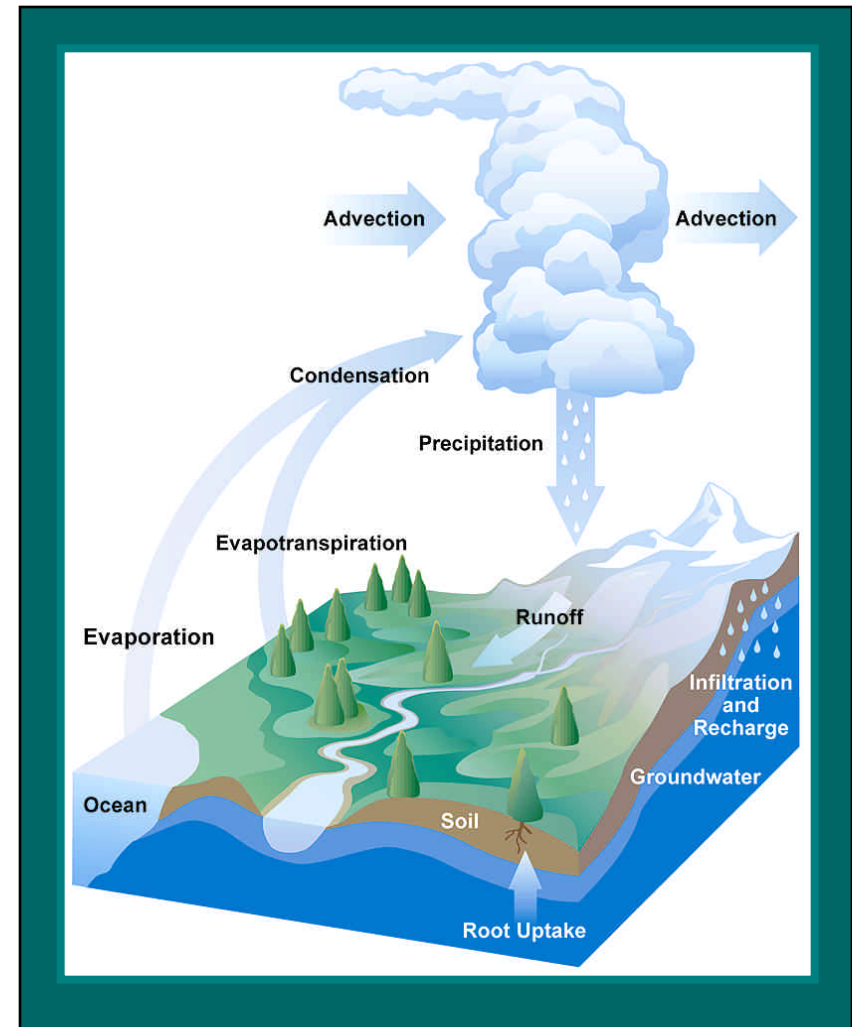


# Securing Our Future: Water Cycle Initiative

## FLOODS, DROUGHTS, AND WATER SUPPLY ARE OF GROWING CONCERN TO SOCIETY

- Goal is to improve predictions of regional water cycle variability
  - Water Cycle Simulation System
  - Regional Testbeds
  - Fundamental Research on Water Cycle Processes
  - Enhanced Observational Technologies and Networks

## LBNL co-chaired research strategy



# Securing Our Future: Center for Deep Underground Science

- Homestake Mine in South Dakota was proposed for conversion into a nuclear science – earth science national lab
- LBNL led the geosciences aspect of a workshop held in October; summary in December AGU Fall meeting
- Multi-level tracer testing, geomicrobiology, and cosmic ray imaging are among many studies benefited from the access to great depth and extensive areal drift coverage



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# Securing Our Future: Regional Carbon Sequestration Center

- LBNL taking leadership role in establishing Center
- Facilitate technology development and public outreach for geologic sequestration of CO<sub>2</sub>
- Partnership of national laboratories, academia, energy producers and users, and state and local government
- Provide region-specific scientific data and options to ensure long-term safety of CO<sub>2</sub> sequestration



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# Securing Our Future: Scientific Self Assessment

- Identification of global scientific target areas
- Evaluation of critical mass in core areas
- Strategic hires
- Strategic studies funded by Programs (supplementing LDRDs and mini-grants)
- Strategic partnerships with other organizations of scientific excellence
- Host important international conferences/workshops
- Develop new scientific insights into important publications in *Science* and *Nature*



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# Enhancing Our Staff/Capabilities

- **Zero tolerance for EH&S deficiencies - every EH&S occurrence is reviewed by Division Director**
- **Every employee of Earth Sciences has specific goals tied to the overall mission of the Division**
- **Management is committed to mentoring and training our future leaders**
- **We are providing our expertise and experience in critical areas such as:**
  - English verbal skills
  - Proposal and technical paper writing
  - Effective communication/interaction with DOE and other sponsors and customers
  - Time management



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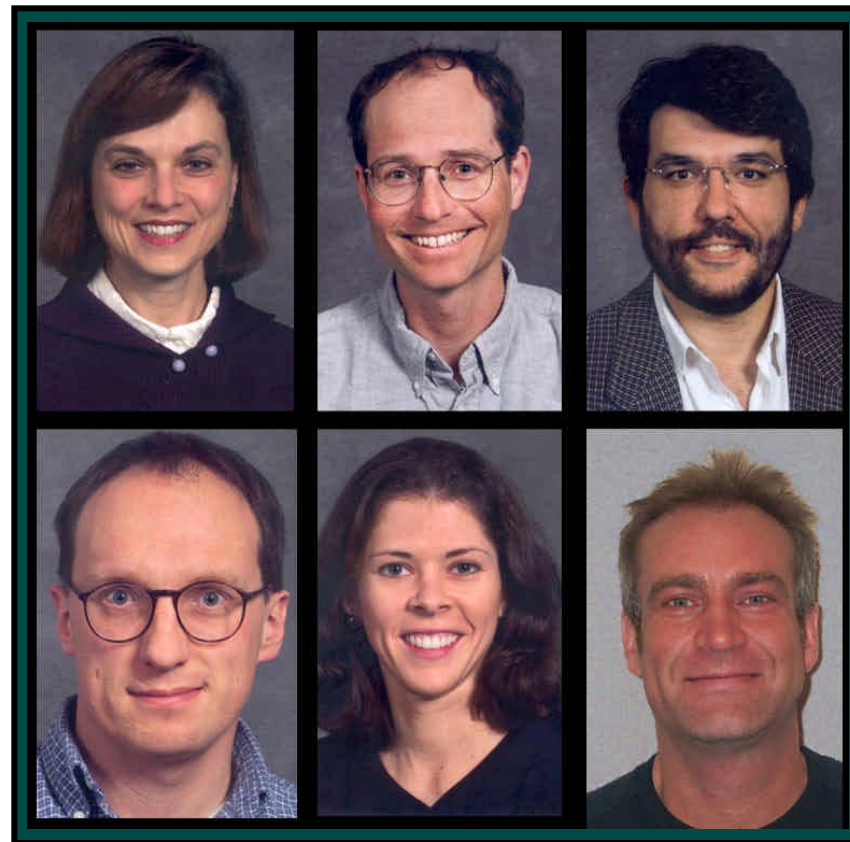
# Enhancing Our Staff - Communication Skills

- A significant portion of our staff speaks English as a second language
- Verbal communication skills are essential for internal and external communication
- We are obligated to enhance this skill in order to prepare employees effectively for future leadership positions



# Succession Planning

- We are committed to mentoring the next generation of leadership in the ESD
- Clear career paths through Group Leader and Program Leader roles
- Supervisors as career coaches in working effectively with DOE, other sponsors and customers
- Leaders responsible for the management of our Division Mini-Grant Program



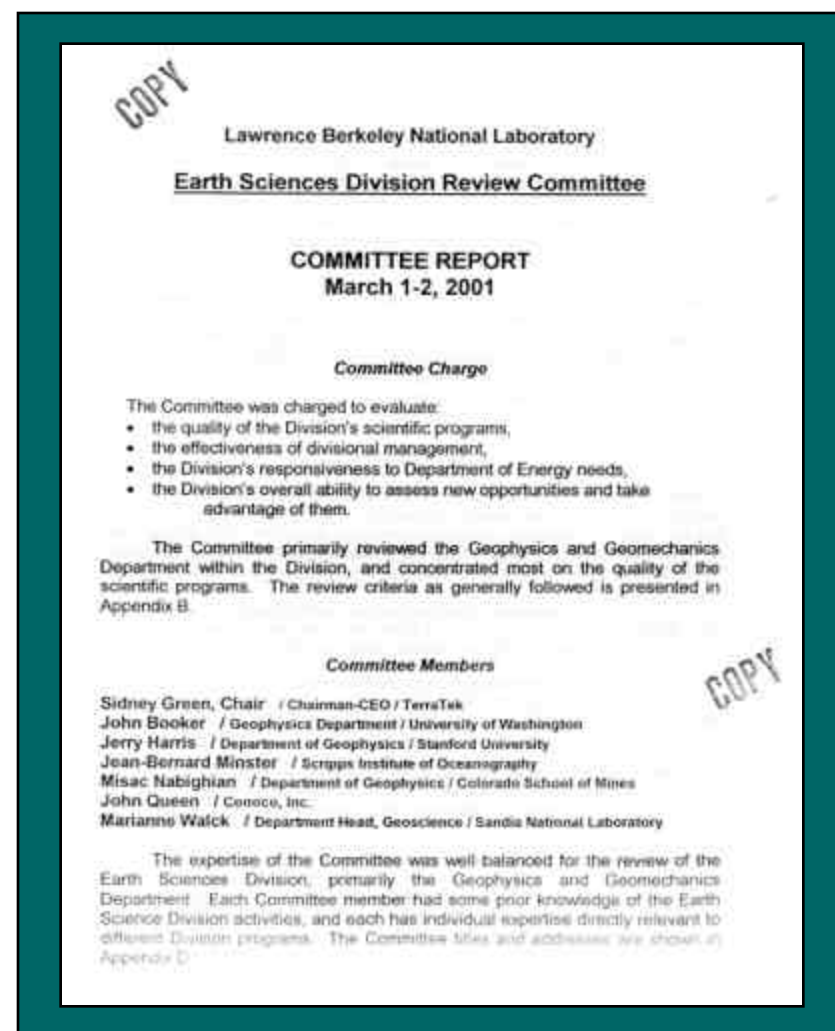
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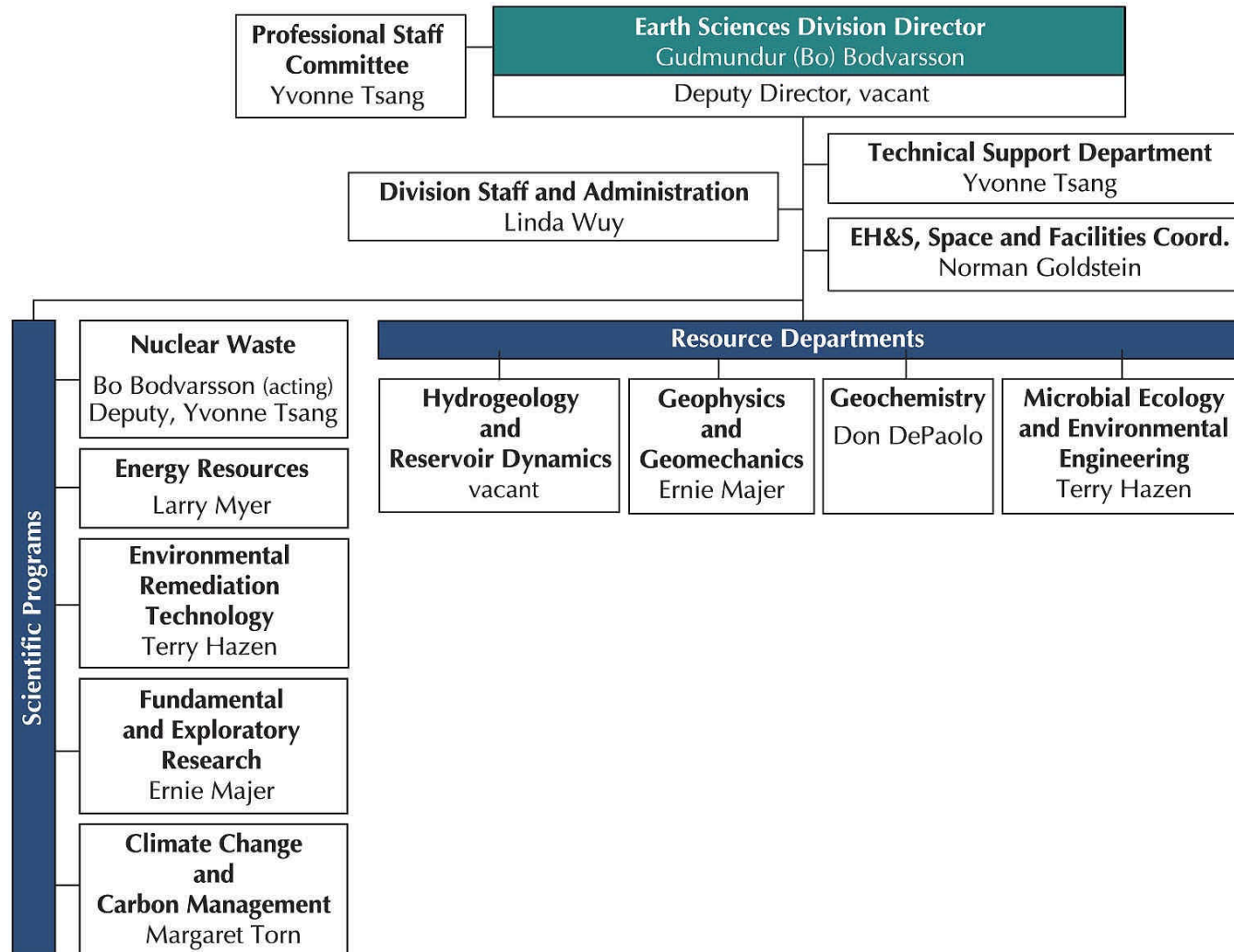
# Criteria for Report Content

- The report needs to be more comprehensive than those done in previous years
- More justification needs to be provided for ratings (outstanding, excellent, etc.)
- We appreciate your participation in this Peer Review!





# ESD ORGANIZATION



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